Tidal Marshes and Native Fishes in the Delta: Will Restoration Make a Difference?
http://caba.ucdavis.edu/seminars/tidal-marshes-and-native-fishes-in-the-delta-will-restoration-make-a-difference

Don Baltz: Gulf Coast Perspective: How Are Tidal Marshes Linked to Estuarine Productivity, Especially of Fish?

- Salt marshes – high productivity low number of fish species
    - Residents are very tolerant of wide swings in salinity and temp
    - Partial residents are often juveniles, shallows near marshes can be nursery habitats when juvenile fishes > adult fishes.
    - Marsh edge = fish refuge during low tide
- Fishes more abundant near marsh edge; if shallow water habitat is not near marsh edge it is not as valuable. Closer to the edge the better
- Shallow turbid water close to the marsh is important nursery habitat for estuarine fishes
- Extra Credit for interested readers: Turner. RE 2001 Est 24:139-150.

Larry Brown – Tidal Wetlands, Restoration, and Fish in the San Francisco Estuary: What Have We Learned in the Past 10 years?

- "Build it and they will come" is the operating hypothesis for tidal wetland restoration
- Do tidal marshes support fish and export production? Some evidence for this in Napa River where organic matter sources fuel the food web for inland silversides fish in some seasons.
- Will it work in the Delta?
    - Delta and North Delta good candidates
    - Phytoplankton production is the dominant energy source to delta's pelagic food web (https://watershed.ucdavis.edu/pdf/crg/Mueller-Solger_et_al2002.pdf and http://www.pnas.org/content/99/12/8101.full.pdf)
    - Phytoplankton declined, less food for zooplankton (hungry), less food for fish = fewer, smaller fish
    - Idea is to reverse that trend by creating more marsh habitat that produces more phytoplankton, more zooplankton, and happier fat fish with lots of friends.
    - Ideas have merit but we don't know how much we will get.

Peggy Lehman – Flux and Carbon Production in Liberty Island Wetland

- It appears Liberty Island wetlands store food and are NOT a NET exporter of food that would substantially support fishes far downstream.
- Liberty Island produces and stores material and carbon, good source of plankton food, vegetated ponds are a source or carbon and material to the larger wetland.
- Tidal flow can be more important than river flow because it redistributes material that was exported for a net storage of carbon on the island.
- Storage may be as important as export because fishes that can access these sites can eat the food within Liberty Island.

SI SIMENSTAD: WHAT HAVE WE LEARNED FROM THE BREACH STUDIES?

- Restoration benefits to fish happen relatively quickly after restoration actions begin. As soon as you restore shallow water habitat near marshes, fish will rapidly occupy them and appear to benefit quickly.
- BREACH studies compared ecological structures and processes in tidal marsh reference sites to restoration sites with breached levees.
- BREACH I – Suisun & Delta, BREACH II North Bay, Breach III North Delta (Liberty Island). Map is here http://depts.washington.edu/calfed/breachii.htm
- Fairly high percentage of native species in breach III – north delta sites

WIM KEMMERER – WHERE DOES PELAGIC FISH FOOD COME FROM?

- Subsidies (exports) of nutrients from marsh – phytoplankton export is possible zooplankton negligible
- Marsh photoplankton productivity v. open water productivity = ~ the same
    - Marshes are a net importer, sometimes exporting phytoplankton possibly, ~ 5%
    - Highest back of the envelope estimate for zooplankton export ~ 0.1% of zooplankton biomass in LSZ is imported from marsh (no accounting for losses to get to LSZ)
- Subsidies between estuarine regions must happen because total grazing is greater than net production of phytoplankton.
- Are fish food limited? – Probably. Smaller and less abundant than they were 25 yrs ago.
- **Limits on phytoplankton production** = light limitation, clam consumption, respiration

- **Limits on zooplankton** = severe food limitation
- Estuarine production -- light limited, controlled by grazing, severe food limitation
- Marsh production -- high light, long residence time, high consumption

CARL WILCOX: Bay Delta Conservation Plan (BDCP): Restoration Goals and Assumptions for Tidal Wetland Linkages to Fish Productivity

- **Large scale restoration perspective**
    - Adds to overall delta habitat complexity
    - Likely to produce services food shelter for many species
    - Current trophic linkages to the Smelts are uncertain
    - Water and its correlate affects on transport, productivity, turbidity, and salinity gradient, still the strongest influence on smelt abundance.
- **Benefits of tidal marsh habitat**
    - Upper San Fran estuary tidal marshes have the highest phytoplankton concentrations and support the greatest zooplankton growth rate
    - Fish use: foraging success and growth rate – in many estuaries fish with access to tidal marsh habitat have been shown to consume much more food and grow much faster than those without access
    - Refuge from predators – large piscivorous fish are rare in tidal marshes and low order tidal channels
- BDCP goals and objectives – expanding tidal natural communities in the plan hypothesized to:
    - Increase local food production to improve spawning and rearing habitat area for delta and longfin smelt and rearing habitat Chinook salmon, splittail, and sturgeon and possibly steelhead
    - Increase local production of food to meet life history requirements of covered species by exporting organic material via tidal flow between intertidal and open water habitats.

BRUCE HERBOLD – SUMMARY WRAP UP COMMENTS

- Delta physically hasn't changed much since 1910 – loss of historical delta happened long

before long term fish declines. For many years fish populations show a more gradual decline not show a step-change consistent with rapid habitat loss.

- Decline can't be because we lost all of that habitat. So what would restoring it do? Does restoration reverse the recent sharp and long term population declines?
- Tidal marsh is productive on site but not as a subsidy to elsewhere. LSZ must have a subsidy b/c clams eat everything produced locally. So where is subsidy coming from?
- Floods and flows move the productivity out and is 'wasted' because the pulse is quick. It is not going to become fish food on the way.
- Where does the productivity go? We don't know why the productivity transforms into a particular form – a native fish? Rare fish? Abundant fish? Abundant zooplankton?
- Build it and they will come was the guiding light of CALFED process. But the fish will come to it (restored habitat), it will not go to them as exported food
- If we are going to use fish as the reason to do something; they better show some benefit of the action.